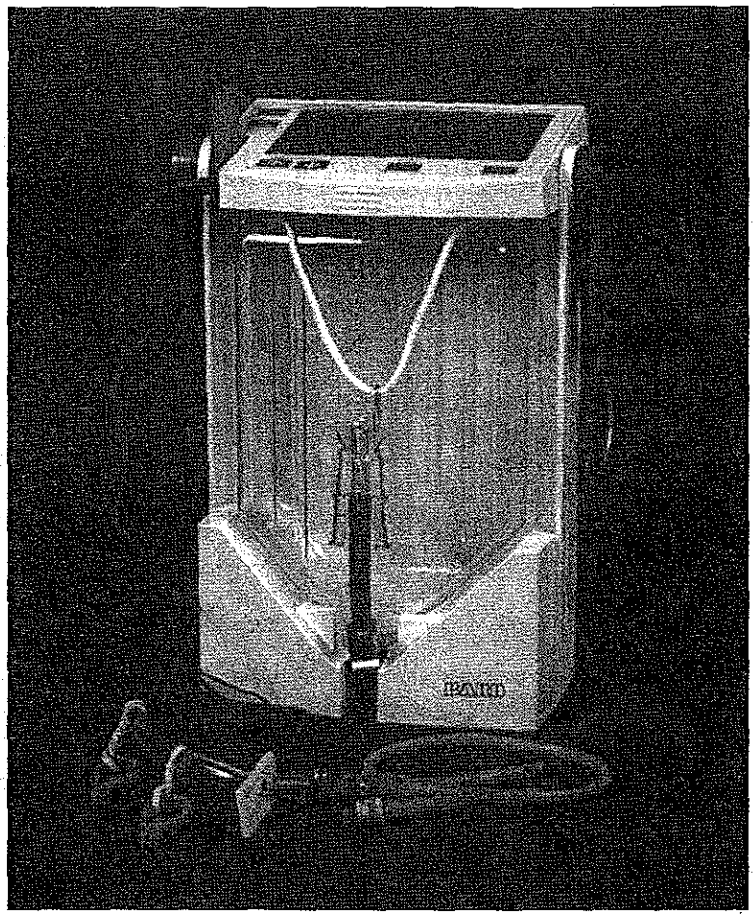
Bard® CritiCore® Monitor Service Manual

Model Number: 000002



Issued: June 1, 1997

PI 3336

C.R. Bard, Inc.
Covington, GA 30014

Copyright © 1997 C. R. Bard, Inc. All rights reserved. Printed in the U.S.A.

Bard and CritiCore are registered trademarks of C.R. Bard, Inc. or an affiliate.

This document and subject matter enclosed herein are proprietary information to which C.R. Bard, Inc. retains the exclusive right of dissemination, reproduction, manufacture, and sale. Any party accepting this document agrees it shall not be duplicated in whole or in part, nor disclosed to others without written consent of C.R. Bard, Inc.

U.S. Patent Nos. 4,448,207, 4,658,834. Other patents applied for.

Notice to Service Personnel

This manual will help you troubleshoot and service the Bard *CritiCore Monitor*. Use this manual in conjunction with the Bard *CritiCore Monitor* Operator's Manual.

Be sure to read these Manuals and become familiar with their contents before attempting to disassemble or repair the Bard *CritiCore Monitor*.

Please consult product labels and inserts for any indications, contraindications, hazards, warnings, cautions and directions for use.

The Bard *CritiCore Monitor* should be serviced by individuals with the credentials of a Certified Biomedical Equipment Technician (CBET) or equivalent only.

Caution: Federal (USA) law restricts this device to sale by or on the order of physician.

Caution: The Bard *CritiCore Monitor* contains static sensitive electronic devices. Do not attempt to disassemble the Monitor without the proper personal and work station grounding apparatus. Failure to properly ground both your body and your work station could result in damage to the Bard *CritiCore Monitor*.

Table of Contents

Introduction 2

Product Description 4
- Communications Module 5

Functional Checkout 7

Troubleshooting Information 13

Mechanical Testing and Repair Procedures 20
- Bezel Enclosure 20
- Bezel Top 22
- Membrane Switch 23
- Display PCB 26
- Temperature Jack 26
- Liquid Crystal Display (LCD) 29
- Arms 32
- Handle 34
- Hooks 35
- Front Enclosure Assembly 36
- Attraction Plates and Magnets 38
- Rear Enclosure 39
- Battery Assembly 41

Details of Electrical Operation 42
- Fluid Output Electronics 42
- Temperature Measurement Electronics 43
- Microcontroller Details 44
- Display Electronics 44
- Keyboard Electronics 44
- Power Management 44

Electronic Testing and Calibration Procedures 46
- Power Modules 46
- Fuse 48
- Transducer 50
- Phototransistor 53
- Tilt Sensor 55
- Temperature Electronics 57
- Main PCB 58
- CritiCore Communications Module 60

Main PCB Component Map 63

Replacement Parts List 64

Product Specifications 66
- Measurement Ranges and Limits 66
- Instrument Specifications 66

Index 68

CritiCore Monitor Schematics 73

Introduction

This manual provides the technical service information necessary to maintain satisfactory operation of the Bard *CritiCore Monitor.* It is intended for use by qualified personnel who are familiar with electro-mechanical devices, and in particular, microprocessor-controlled patient monitors. Use this manual in conjunction with the Bard *CritiCore Monitor* Operator's Manual.

The contents of this manual are summarized below.

1. **Product Description**—Description of Bard *CritiCore Monitor* functions, specifications, and product information.
2. **Functional Checkout**—Use this test procedure to verify correct operation of the Monitor. If the Monitor fails any test within the checkout, the CBET will be referred to the necessary sections of this manual for further testing. After repair is made (by either Bard or the CBET), use the Functional Checkout procedure to verify correct operation before returning the Bard *CritiCore Monitor* for general use.
3. **Troubleshooting Information**—For monitors with an obvious or predetermined failure, use this guide to identify the necessary tests to isolate the problem.
4. **Mechanical Testing and Repair Procedures**—Use these procedures to test, disassemble and reassemble the Monitor. After repair is made (by either Bard or the CBET), use the Functional Checkout procedure to verify correct operation before returning the Bard *CritiCore Monitor* for general use.
5. **Electronic Testing and Calibration Procedures**—Use these procedures to test and calibrate the electronics of the Monitor. After repair is made, use the Functional Checkout procedure to verify correct operation before returning the Bard *CritiCore Monitor* for general use.
6. **Replacement Parts Kit List**—Listing of available Bard replacement parts.

Note: The Bard *CritiCore Monitor* contains many custom mechanical and electronic components. To ensure safe and proper operation of the Monitor, use only Bard replacement parts as specified in the replacement parts kit list.

7. **Product Specifications**—Measurement ranges and limits along with instrument specifications.
8. **Schematics**—Schematic diagrams for the *CritiCore Monitor.* Includes control block diagrams and timing charts.

Warranty Repairs

Bard provides a 90-day limited warranty on each Bard *CritiCore Monitor.* All repairs on products under warranty must be performed at a Bard designated repair facility. If there is any evidence of unauthorized service the customer may forfeit any warranty provisions and may be billed for the repairs required to return the Monitor to its original condition.

To obtain technical support, product information, and for placing orders contact Bard Customer Service at 1-800-526-4455.

Non-Warranty Repairs

Monitors no longer under warranty may be repaired within the following constraints:

1. Only components included in the replacement parts list are used to make the repair.
2. No component has been removed from the Monitor unless that component is specified in the replacement parts list.
3. Each repaired Bard *CritiCore Monitor* passes the Functional Checkout (see page 7) before it is returned for general use.

Call Bard Customer Service Department (1-800-526-4455) to order components necessary to complete a repair.

Contacting Bard

For **orders** and **technical support**, contact Bard Customer Service at **1-800-526-4455** between 8:30AM and 4:30PM eastern time, Monday through Friday. When calling for technical support, please be prepared to supply the following information:

- Your Name
- Hospital Name
- Address
- Telephone Number
- Unit Model Number
- Unit serial number
- Description of the reported problem
- Was the Monitor used on a patient when the problem occurred?
- Patient status and type of intervention required (if applicable).

If you are advised to return the Monitor to a Bard-designated repair facility, a Return Authorization Label or detailed mailing instructions, with the name and address of the repair facility, will be supplied to you by your Bard Customer Service Representative.

To return the Bard *CritiCore Monitor* for service:

1. Remove and dispose of 6 D-cell batteries.
2. Package the Monitor with adequate protection. If available, use the original materials in which the Monitor was shipped.
3. Include a brief description of the problem as well as the name and phone number of the person to be contacted for additional information.

Note: Apply a label with the return authorization number to the shipping carton.

3. Ship the Monitor **Transportation Prepaid** to the location specified by your Bard Customer Service Representative.
4. If requested, Bard will evaluate the Monitor and provide an estimate before any repairs are made.

Product Description

The Bard *CritiCore* System consists of a fluid output and core temperature monitor, a disposable collection system, and disposable temperature probes (temperature-sensing Foley catheters).

Note: Consult the Operator's Manual for details on all Bard *CritiCore Monitor* functions.

Fluid Ouput

The Bard *CritiCore Monitor* electronically measures fluid output volume utilizing ultrasound technology. During operation, the disposable container rests within the Monitor and sits on top of a silicone rubber transducer cap. Underneath the silicone rubber cap is the transducer element, which will periodically transmit a controlled burst of ultrasonic energy up through the container. Ultrasonic energy will travel through the fluid and reflect back towards the transducer at the fluid/air interface. The transducer also functions as receiver, detecting the return of the transmitted burst. The microcontroller within the *CritiCore Monitor* will measure the time the energy burst took to make the round-trip. This information is then converted into container volume.

Temperature Measurement

Bladder Temperature is measured by a temperature-sensing Foley catheter. The temperature sensor integral to the disposable catheter is a "400-Series" thermistor. As the *Bladder Temperature* changes, so does the resistance of the thermistor. Sensitive electronics in the Bard *CritiCore Monitor* will detect any change in the resistance of the thermistor. The resistive value of the 400-Series thermistor is converted into a corresponding relative temperature reading.

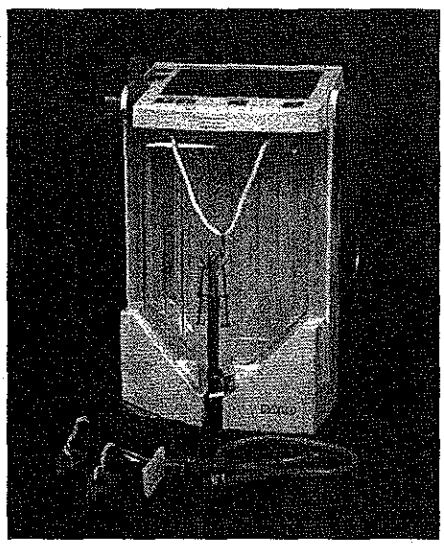


Figure 1

The *CritiCore Monitor* incorporates the following features:

- *Present Interval Output* Calculation
- *Prior Interval Output* Calculation
- *Cumulative Output* Calculation
- *Container Volume* Measurement
- *Flow Rate* Calculation

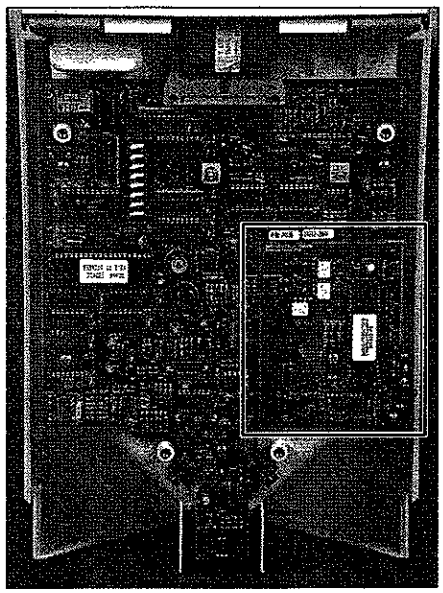


Figure 2

Communications Module

The Bard *CritiCore Monitor* was designed to accommodate the Bard *CritiCore Communications Module* (highlighted area in Figure 2). The function of the *CritiCore Communications Module* (CCM) is to permit communications between a computer or patient data management system and the *CritiCore Monitor.*

Note: Consult the CCM Operator's Manual for details on all CCM functions.

With the CCM, the user may configure the *CritiCore Monitor* to transmit data in one of four modes (see Figure 3):

- **210 Emulation mode**—Emulates the manner in which the Bard Urotrack® Model 210 Monitor communicates its data. Flow rate and container volume are transmitted in this mode.
- **220 Emulation mode**—Emulates the manner in which the Bard Urotrack Model 220 and Urotrack Model 224 Monitors communicate their data. Bladder temperature and container volume data are transmitted in this mode.
- **Standard mode**—This mode is designed to access all of the information available from the Bard *CritiCore Monitor.* Flow rate, bladder temperature and container volume data are transmitted in this mode.
- **FlexPort® mode**—Allows the user to set up communication between the Bard *CritiCore Monitor* and a SpaceLabs Medical Patient Care Management System (PCMS®) Monitor.

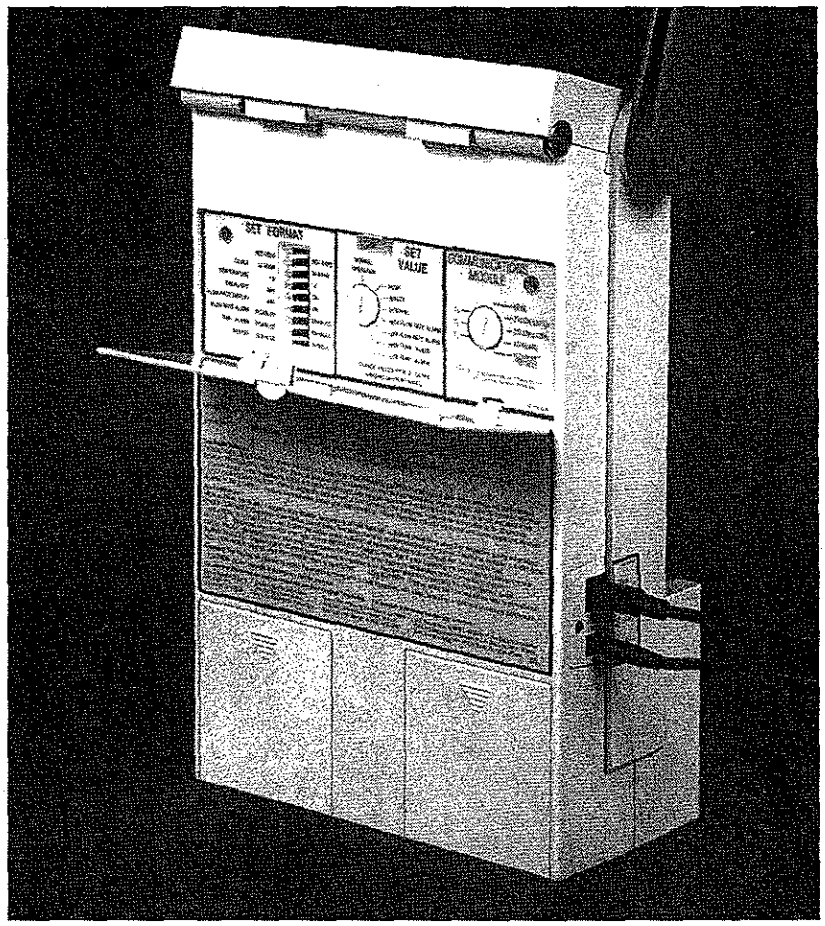


Figure 3—CritiCore Monitor with CCM Installed

Functional Checkout Product Identification

The Functional Checkout procedure is designed to verify that the *CritiCore Monitor* is functioning properly before it is placed into service. This procedure is available in the Operator's Manual, which is supplied with every Monitor purchased. The Operator's Manual can also be purchased separately (see the Replacement Parts List on page 68). The Functional Checkout procedure is repeated here for reference. In addition to the Functional Checkout procedure are the use of the T_1 - T_3 Monitor test modes. The use of these test modes will be discussed in the Additional Testing Modes section on page 12.

Self Test

1. If the Bard *CritiCore Monitor* has been turned on recently, be sure it has been turned off for at least 10 minutes before initiating the self test.
2. Hang the Monitor from a stable level bracket or set it on a stable level surface.
3. Clean both the cavity that holds the collection container and the silicone rubber transducer cap located at the bottom of the cavity.

Note: Use a soft non-abrasive cloth dampened with warm water and mild detergent, alcohol or a non-staining disinfectant.

4. Open the rear control panel door to reveal the rear panel switches
5. Set the toggle and rotary switches as follows:

Set Format		Set Value	Test Switch
CLOCK	12 Hr.	Normal Operation	Normal Operation
TEMPERATURE	°F		
BACKLIGHT	Off		
FLOW RATE DISPLAY	Off		
FLOW RATE ALARM	Disabled		
TEMP. ALARM	Disabled		
BEEPER	Audible		

6. Press the *ON/OFF* switch on the membrane switch to turn the Monitor *ON*.

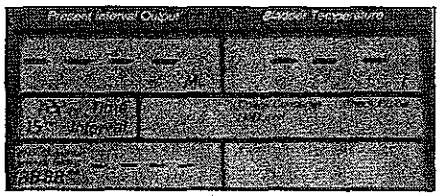


Figure 4

The Monitor will emit a short "beep" and perform a self test. This self test should take about 4 seconds. After the self test the Monitor will automatically enter the normal operation mode.

Note: If the Monitor fails the self test, an error code "PPPP" will appear in the top display.

Once the self test is completed and successful, the display should resemble Figure 4 with the exception of Not Level Indicator.

Note: The current time of day, time of the previously selected interval and interval length may differ from Figure 4.

Check Container Status

1. Lift the display assembly and install an empty disposable container into the Monitor's front cavity.
2. Lower the lid ensuring that it completely closes and traps the container within the Monitor.
3. Verify that the *Check Container* status indicator on the display is **not** lit, and "0 ML" appears in the *Present Interval Output* display.

Temperature

1. Install a temperature-sensing Foley catheter or a temperature calibration plug into the temperature jack on the left side of the display assembly.

Note: A precision (0.1% or better) decade box set to 1354.7Ω and connected to a 3.5mm mono mini-phone plug may be used instead of a calibration plug. See page 59 for table of calibration plug resistances.

2. Verify that the *Check Probe* status indicator disappears and that a temperature reading appears in the *Bladder Temperature* display. If employing a temperature calibration plug the value should be *98.6°F ± 0.2°F.*
3. Remove the temperature calibration plug or temperature-sensing Foley catheter and verify that the *Bladder Temperature* window displays "--.-" and that the *Check Probe* status indicator is lit.

System Clock

1. Turn the SET VALUE rotary switch on the rear control panel to the HOUR position. Verify that the hour segment, *PM/AM* and *Set Value* status indicators are flashing.
2. Use the ↑↓ switches on the membrane switch to set the system clock to the correct hour.
3. Turn the SET VALUE rotary switch on the rear control panel to the MINUTE position. Verify that the minute segment and *Set Value* status indicator are flashing.
4. Use the ↑↓ switches on the membrane switch to set the minutes of the clock to the correct time of day.
5. Return the SET VALUE rotary switch to the NORMAL OPERATION position and verify that the correct time appears on the display. Verify that the *Set Value* status indicator is not lit.

Intervals

1. Turn the SET VALUE rotary switch to the INTERVAL position. Verify that the interval segment, *HR/MIN* and *Set Value* status indicators are flashing.
2. Use the ↑↓ switches on the membrane switch to display the following intervals: *5 MIN*; *10 MIN*; *15 MIN*; *20 MIN*; *30 MIN*; *1HR*; *2HR.*
3. Set the interval length to the preferred interval and return the SET VALUE rotary switch to the NORMAL OPERATION position.

Patient Data Reset/Present Interval Output/Container Volume

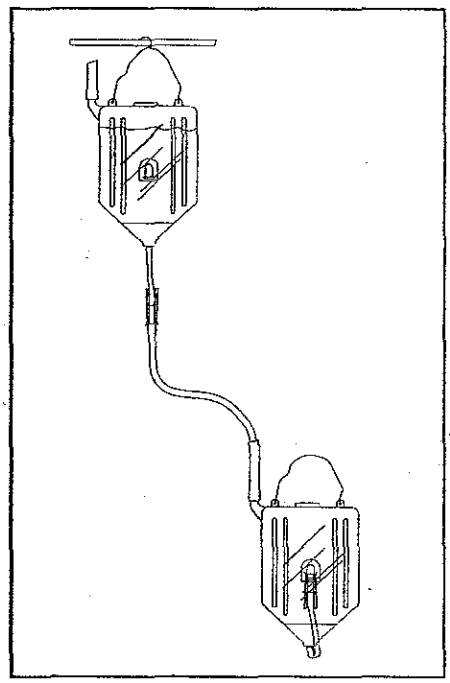


Figure 5

1. Fill a disposable container with water (approximately 2100ml) and hang it so that it is higher than the Monitor.

Note: A 60cc irrigation syringe can be used to fill the collection container or two *CritiCore* disposable containers can be used for this procedure. These containers should be dedicated for test use only.

If an irrigation syringe is used, proceed to step 5, otherwise continue with step 2.

2. Cut the inlet tubing of a second disposable container one inch below the urine sample port connector.
3. Install the modified second empty container into the Monitor.
4. Insert the plastic molded Control Fit connector at the end of the drain tube on the filled container into the soft plastic tubing on the second container extending from the Monitor (see Figure 5).
5. Press the *ON/OFF* switch to turn the Monitor *ON*.
6. Using either the irrigation syringe or a second disposable container, allow approximately 100ML of water to drain into the container in the Monitor.
7. Wait approximately 10 seconds after the water has drained into the Monitor and the surface of the water is steady. The Monitor should read approximately "100 ML" in the *Present Interval Output* display.
8. Press the *Container Volume* switch. The display should read approximately "100 ml" Verify that the container volume disappears 30 seconds after the container volume switch is pressed.
9. Press and hold the *Patient Data Reset* switch until a short "beep" is heard.
10. Press the *Container Volume* switch a second time. The *Container Volume* display should read within 3ml of the value noted in Step 8 and the *Present Interval Output* display should read between "0" and "3 ML".

Flow Rate

1. Set the FLOW RATE toggle switch to the *ON* position.
2. Set the *Interval* length to "*1 HR.*"

Note: If at least 15 minutes remain in the current hour, proceed with step 3. If less than 15 minutes remain in the current hour, wait until the beginning of the hour before proceeding with step 3.

3. Press and hold the *Patient Data Reset* switch until a short "beep" is heard. Verify that "0 ML" appears in the *Present Interval Output* display and that dashes "----" appear in the *Flow Rate* display.
4. Allow a small amount of water to drain into the container in the Monitor. The *Present Interval Output* should display a new reading within 15 seconds after the water flow has stopped and the water surface is steady.

5. Repeat step 4 after each minute increment for 10 consecutive minutes, adding only a small amount of water each time.

   After exactly 10 minutes the current *Flow Rate* display should change from dashes "---" to a value that is 6 times the value in the *Present Interval Output* display.

Not Level Indicator

1. With the Monitor *ON*, tilt the Monitor.
2. Verify that the *Not Level* status indicator becomes lit.
3. Return the Monitor to a level position and verify that the *Not Level* indicator disappears.

Full Container Alarm

1. Open the drain clamp on the upper container or use an irrigation syringe to fill the container in the Monitor to 2050 ml of water.
2. Verify that the *Full Container* status indicator flashes and an audible alarm is heard. Note that the BEEPER toggle switch should be in the AUDIBLE position.
3. Press the *Container Volume* switch and verify that the *Container Volume* displayed is greater than 2000ml and is flashing.
4. Drain about 200ml from the Monitor container and verify that the *Full Container* status indicator is not lit and the audible alarm stops beeping.
5. Press the *Container Volume* switch and verify that the *Container Volume* displayed is less than 2000ml and is not flashing.

High Temperature Alarm

Before performing this procedure, remove any temperature probes or calibration plugs and reset the Monitor.

1. Set the TEMP ALARM toggle switch to the ENABLED position and the BEEPER toggle switch to the AUDIBLE position.

   Verify that the bell icon appears in the upper right corner of the *Bladder Temperature* display.
2. Turn the SET VALUE rotary switch to the HIGH TEMP. ALARM position.
3. Verify that the *Set Value* status indicator and 101.0°F flashes on the display. The *High Alarm* and *Check Probe* status indicators should also be lit.

Note: The 101.0°F will appear only if the temperature alarm default limit has not been reset or if both battery packs have been removed for an extended period of time.

4. Use the ↑↓ switches on the membrane switch to set the alarm limit to 98.4°F.
5. Turn the SET VALUE rotary switch to the NORMAL OPERATION position. Insert a 98.6°F calibration plug. Verify that the *High Alarm* status indicator is lit, the value in the *Bladder Temperature* display is 98.6± 0.2 °F, and is flashing and the audible alarm is beeping.

6. Press the Alarm silence switch to verify that the audible alarm stops, the value in the *Bladder Temperature* display continues to flash and the *Alarm Silenced* status indicator is lit.
7. Reset the High Temperature Alarm limit to the preferred high temperature alarm value.

Low Temperature Alarm

1. Remove the calibration plug and reset the Monitor.
2. Turn the SET VALUE rotary switch to the LOW TEMP. ALARM position and verify that the *Set Value* status indicator and 50.0°F (10.0°C) flashes on the display. The *Low Alarm* and *Check Probe* status indicators should also be lit.

Note: The 50°F will appear only if the temperature alarm default limit has not been reset or if both battery packs have been removed for an extended period of time.

3. Use the ↑↓ switches on the membrane switch to set the alarm limit to 99.0°F.
4. Turn the SET VALUE rotary switch to the NORMAL OPERATION position.
5. Insert a 98.6°F calibration plug. Verify that the *Low Alarm* status indicator is lit and the audible alarm is beeping.
6. Reset the Low Temperature Alarm limit to the preferred low temperature alarm value.

Backlighting

1. Place the BACKLIGHT toggle switch in the *ON* position.
2. Press any switch on the membrane switch.
3. Do not touch any other key. Verify that the display backlight is on and that it will automatically shut off after 30 seconds.

Note: It may be necessary to dim the room lighting before the Monitor backlight is visible.

4. If the Monitor will be used in well-lit conditions return the BACKLIGHT toggle switch to the OFF position to maximize battery life.

Completion

At this point the Functional Checkout Procedure is complete. Store the two containers used to hold fluid so they can be used to check the Monitor as required.

Additional Testing Modes

There are two manufacturing test modes available for further checkout of the *CritiCore Monitor*. Located on the rear control panel, T_2 and T_3 can provide additional information on the status of certain functions. Please note that test mode T_1 is used only for calibration of the temperature circuitry. Calibration is discussed in the Installing and Calibrating the Main PCB procedure (on page 60) and should only be performed by qualified personnel.

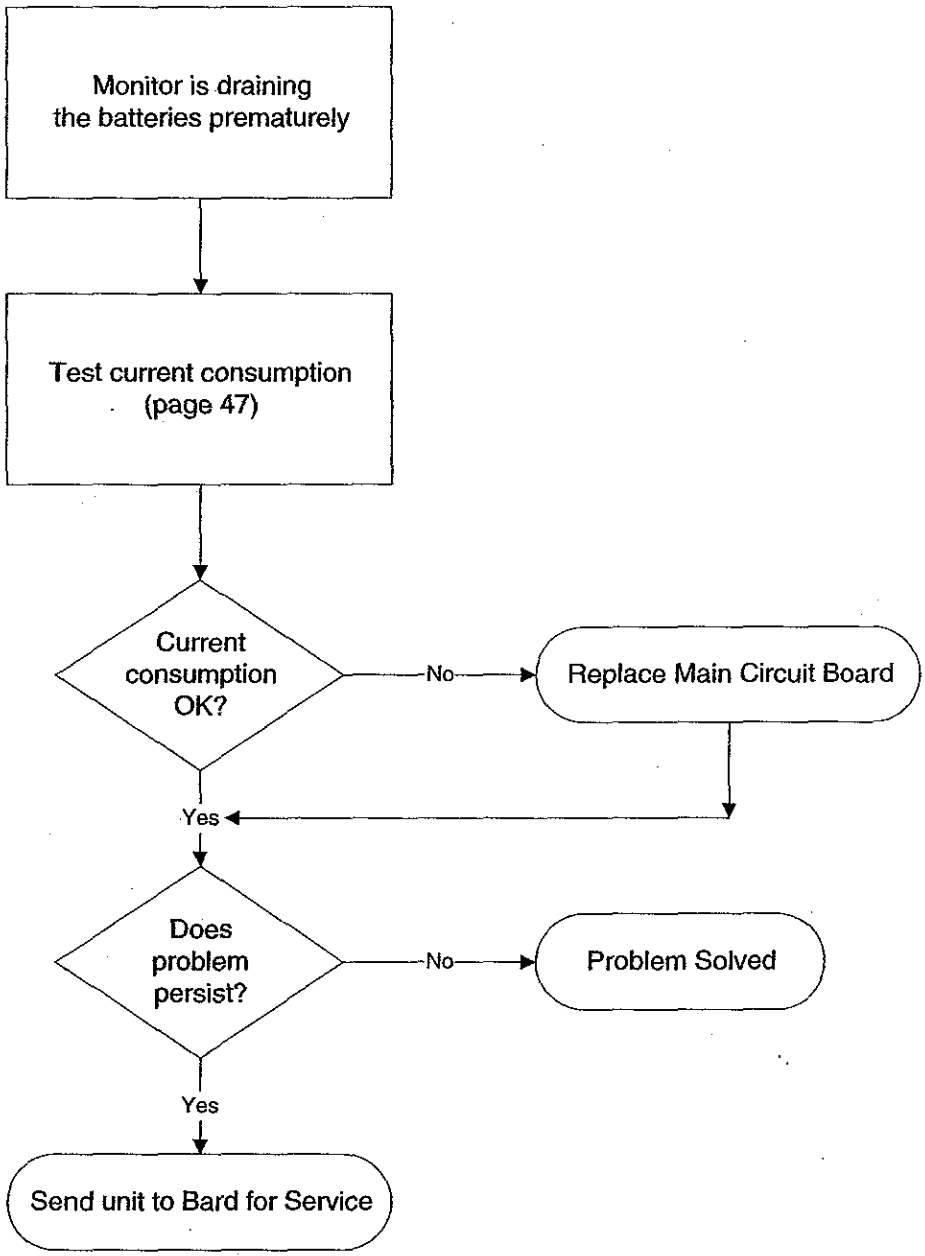
When the rotary TEST SWITCH is rotated to the T_2 position, the Monitor will enter into a display testing mode. This mode will cause the display to begin cycling through a sequence of decimal and hexadecimal numbers/letters. Once in T_2 mode, the cycle will continue regardless of any toggle or rotary switch settings. This allows the technician to verify that all segments of the Liquid Crystal Display (LCD) are functioning properly. See the Testing the LCD Display procedure (on page 30) for details on this test mode.

When the rotary TEST SWITCH is rotated to the T_3 position, the Monitor will enter into a software checksum and revision display mode. In the *Present Interval Output* window, the software checksum will be displayed. In the *Bladder Temperature* window, the software revision number is displayed. If necessary, have the Monitor's serial number available and contact your Bard Customer Service Representative for the correct values.

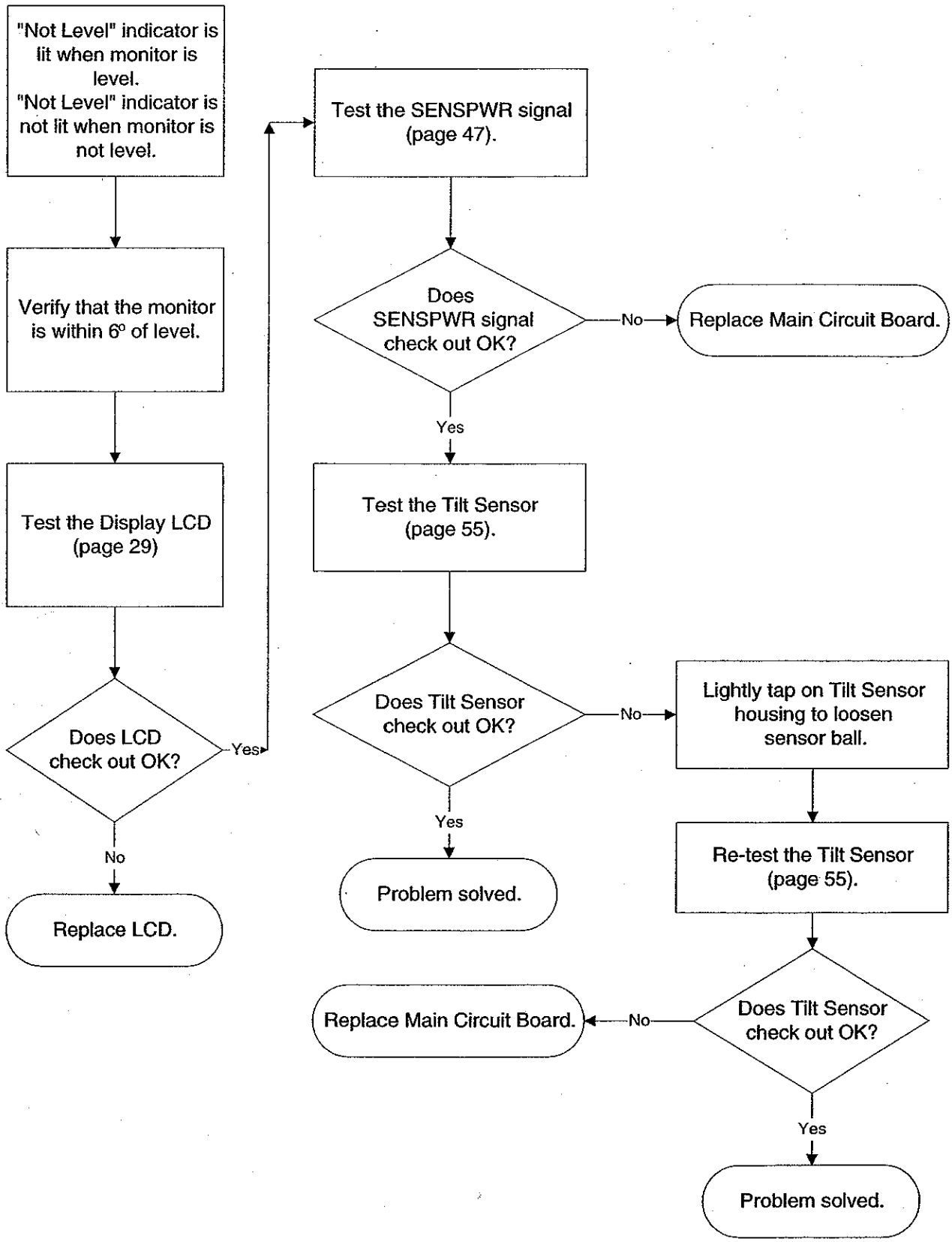
Troubleshooting Information

The following troubleshooting flowcharts are provided to help diagnose problems with your Bard *CritiCore Monitor*.

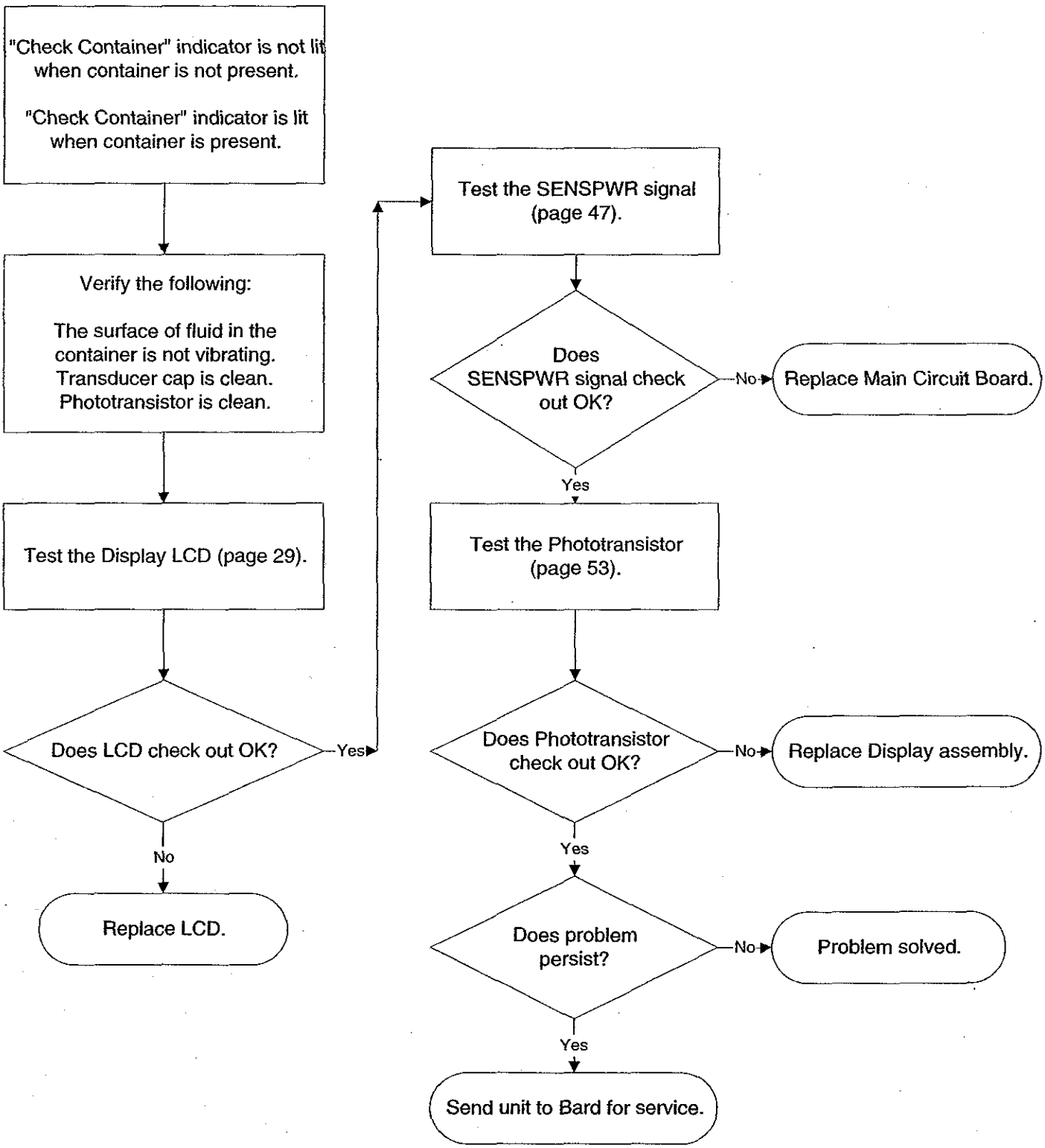
Short Battery Life Troubleshooting Flow Chart



Tilt Sensor Troubleshooting Flow Chart

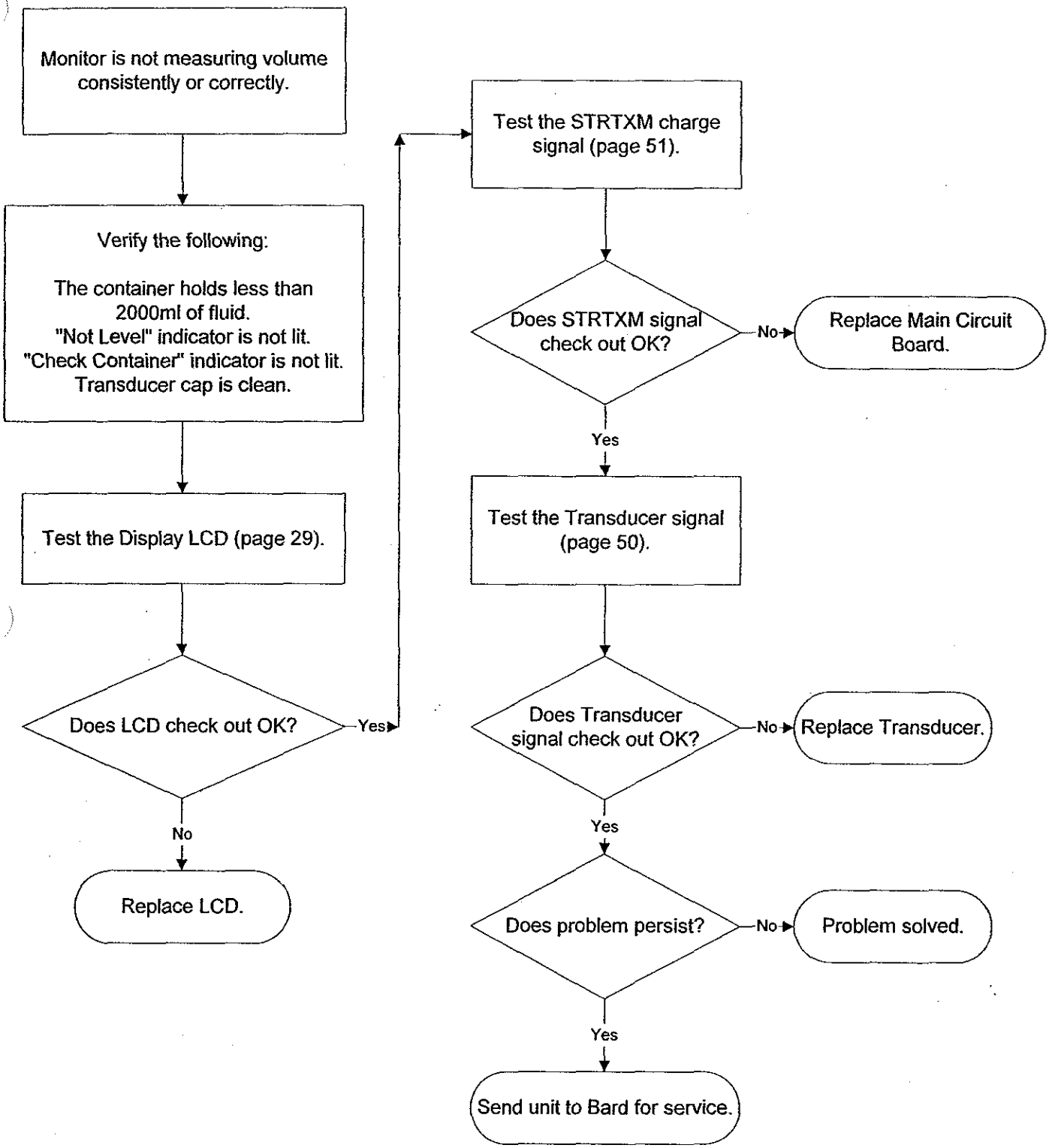

"Not Level" indicator is lit when monitor is level.
"Not Level" indicator is not lit when monitor is not level.
Verify that the monitor is within 6° of level.
Test the Display LCD (page 29)
Does LCD check out OK?
Yes
No
Replace LCD.
Test the SENSPWR signal (page 47).
Does SENSPWR signal check out OK?
No
Replace Main Circuit Board.
Yes
Test the Tilt Sensor (page 55).
Does Tilt Sensor check out OK?
No
Lightly tap on Tilt Sensor housing to loosen sensor ball.
Yes
Problem solved.
Re-test the Tilt Sensor (page 55).
Does Tilt Sensor check out OK?
No
Replace Main Circuit Board.
Yes
Problem solved.

Container Sensor Troubleshooting Flow Chart

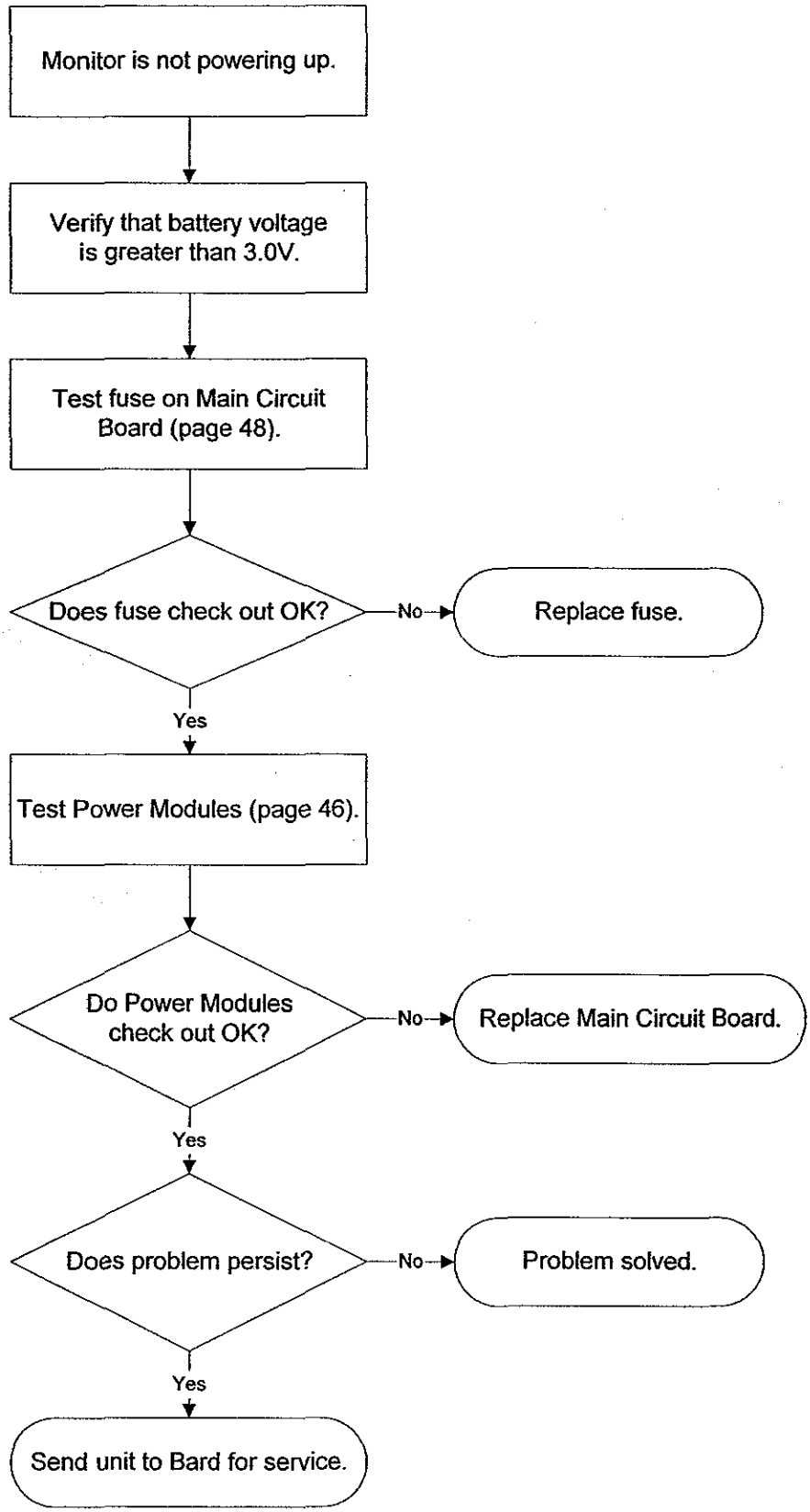


Temperature Measurement Troubleshooting Flow Chart

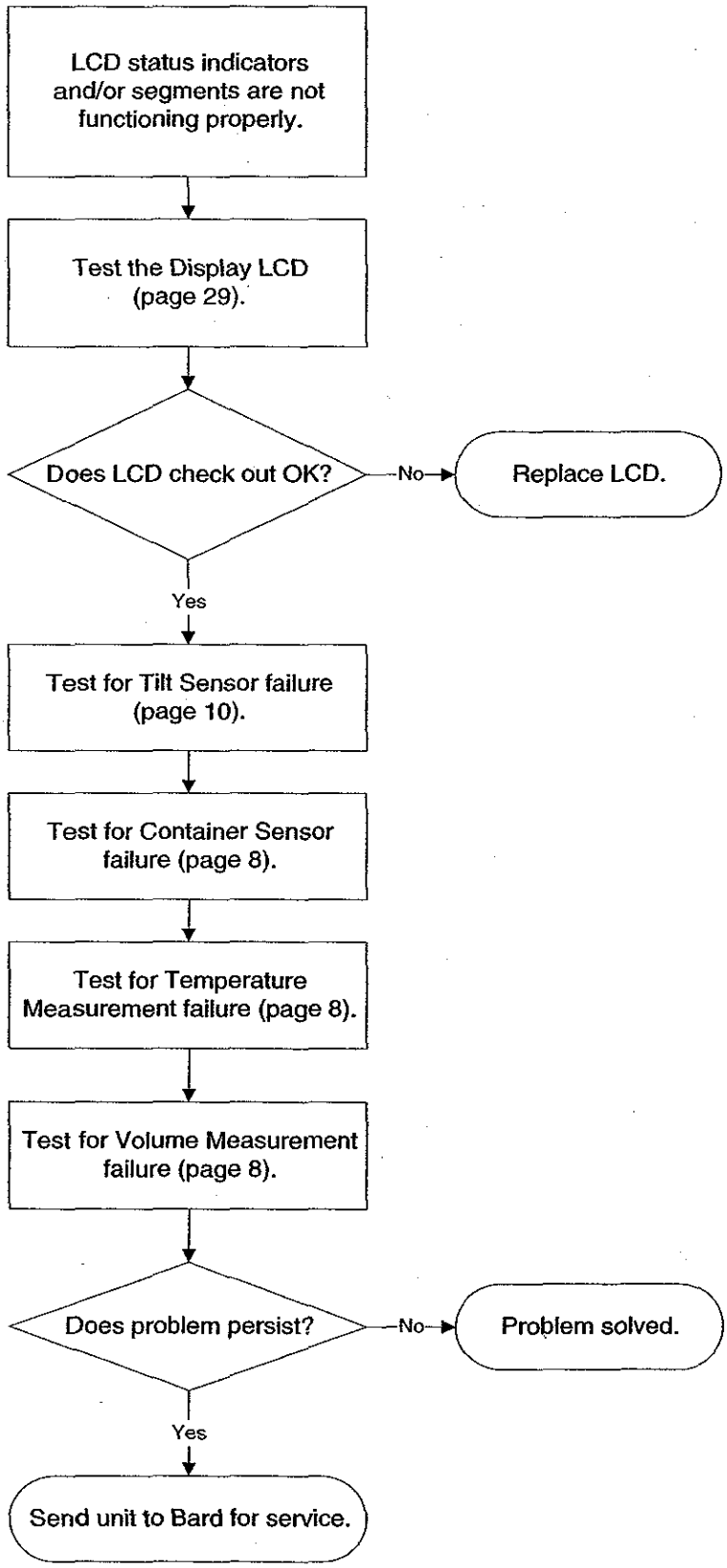
Volume Measurement Troubleshooting Flow Chart



Power Troubleshooting Flow Chart



LCD Display Troubleshooting Flow Chart


LCD status indicators and/or segments are not functioning properly.
Test the Display LCD (page 29).
Does LCD check out OK?
No
Replace LCD.
Yes
Test for Tilt Sensor failure (page 10).
Test for Container Sensor failure (page 8).
Test for Temperature Measurement failure (page 8).
Test for Volume Measurement failure (page 8).
Does problem persist?
No
Problem solved.
Yes
Send unit to Bard for service.

Mechanical Testing and Repair Procedures

The following sections outline the appropriate testing, disassembly and re-assembly procedures for the individual mechanical components of the Bard *CritiCore Monitor.*

Bezel Enclosure

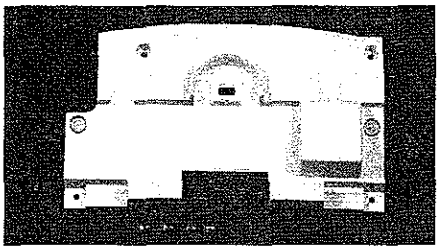


Figure 6

The bezel enclosure (Figure 6) protects the underside of the display PCB from impact and contamination by foreign matter. The bezel is directly attached to the bezel top and is hinged to the front enclosure by the hinge pins. The magnets inserted and affixed to the bezel enclosure are drawn to the attraction plates which are attached to the front enclosure. The force of attraction is necessary to apply pressure to the top of the disposable container. The force on the container cap ensures that the container is firmly seated on the transducer cap. This in turn allows for minimal transducer signal loss when the container holds little or no fluid.

Testing the Bezel Enclosure

Visually inspect the bezel enclosure for damage. If the bezel enclosure is broken or cracked, it may allow fluid to enter into the display PCB and should be replaced. If one or both of the magnets are missing or damaged, they must be replaced. See the Attraction Plates and Magnets section (on page 40) for magnet replacement procedure.

1. Place a disposable container into the Monitor.
2. Lift the display assembly up approximately 1/2 inch and allow it to drop onto the container cap. The display assembly should drop unhindered and rest on the container cap.
3. If the bezel enclosure hinge pin insert is cracked, or if there is foreign material inside the hinge pin/insert junction, the movement of the display assembly may be hindered. To inspect for cracks inside the hinge pin insert, remove the hinge pins as described in the Removing the Bezel Enclosure procedure (below). If cracks are found, the bezel enclosure must be replaced. If foreign matter is the cause, clean out the plastic insert and hinge pin by using a non abrasive cloth dampened with 70% isopropyl alcohol.

Removing the Bezel Enclosure

Equipment Required

- No. 2 Phillips screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

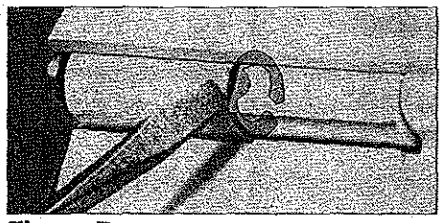


Figure 7

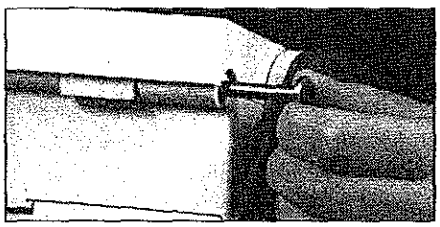


Figure 8

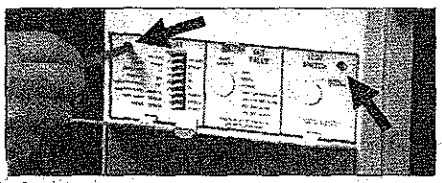


Figure 9

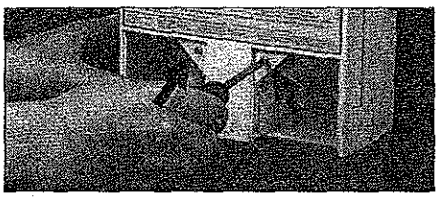


Figure 10

Note: Review the contents of the bezel enclosure replacement parts kit (see Replacement Parts List on page 66), to confirm which parts you may need to keep/discard during disassembly.

Procedure

1. Ensure that the Monitor is turned off. Remove the battery doors and battery packs.
2. Place the Monitor face down on a soft surface.
3. Remove the hinge pins which connect the display assembly to the Monitor enclosure. Each hinge pin has an e-style snap ring mounted on it. The snap ring must be removed in order to pull out the hinge pin. The snap ring must be oriented properly, as illustrated in Figure 7 in order to remove it. If the snap ring is not properly oriented, rotate it into correct position by using a small flathead screwdriver.
4. Using a needle-nose pliers, remove both snap rings.
5. After removing both snap rings, pull out both hinge pins as illustrated in Figure 8.
6. Open the rear control panel door. Ensure that both the SET VALUE and the TEST SWITCH rotary knobs are set to NORMAL OPERATION, then pull gently to remove the rotary knobs.
7. Remove the four (4) 6-32x3/8" Phillips pan-head screws as illustrated in Figures 9 and 10 (arrows indicate screw locations). Close the rear panel door.
8. Pull straight up on the rear enclosure (see Figure 11) to separate it from the front of the Monitor. The arrow in Figure 11 illustrates how to hold the blank insert in place while removing the rear enclosure. Remove and set aside the blank plastic insert.
9. Pull out on the ejector latches on the display cable connector (see Figure 12). Disconnect the display cable from the main PCB. At this point the display assembly is totally detached from the Monitor.
10. Place the display assembly on a soft surface so that the membrane switch is face down.
11. Separate the bezel enclosure from the bezel top assembly by removing the four (4) 6-32x1/4" Phillips pan-head screws.

Installing the Bezel Enclosure

Equipment Required

- No. 2 Phillips screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

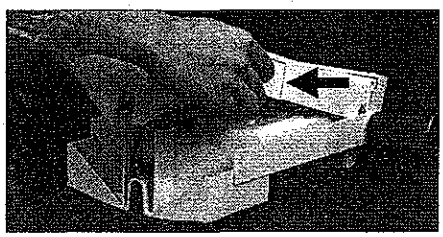


Figure 11

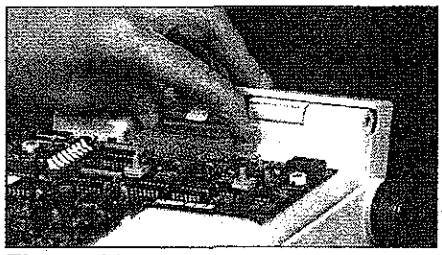


Figure 12

Procedure

1. Install the bezel enclosure to the bezel top assembly by installing the four (4) 6-32x1/4" Phillips pan-head screws.
2. Reconnect the display cable connector to the main PCB (see Figure 12). Ensure that the cable has been fully inserted and that the ejector latches are firmly closed.
3. Place the rear enclosure onto the front enclosure, ensuring that the plastic blank insert is held into position as illustrated in Figure 11. Install the rear enclosure by installing the four (4) 6-32x3/8" Phillips pan-head screws (see Figures 9 and 10).
4. Ensure that the display assembly is correctly oriented so that the holes for the hinge pins are clear.
5. Insert the two hinge pins (see Figure 8), and replace the snap rings.
6. Insert and connect the battery packs and install the battery doors.
7. Stand the Monitor up, open the rear control panel door and reattach the SET VALUE and TEST SWITCH rotary knobs, ensuring that the arrows on the two knobs are oriented in the same direction that they were in when they were removed.
8. Perform the Functional Checkout procedure (see page 7) to ensure that all display and general Monitor functions are working properly.

Bezel Top

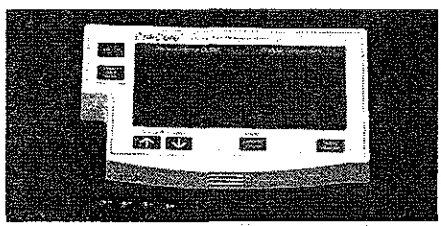


Figure 13

The bezel top is the outermost plastic enclosure of the display assembly. The membrane switch, bezel enclosure and display PCB/LCD assembly are directly attached to the bezel top. The bezel top is assembled to the bezel enclosure which is hinged by the hinge pins to the front enclosure. Figure 13 shows a bezel top with the membrane switch installed.

Testing the Bezel Top

Visually inspect the bezel top for damage. If the bezel top is broken or cracked, it may allow fluids to enter into the display PCB and should be replaced.

Removing the Bezel Top

Equipment Required

- No. 1 Phillips screwdriver
- No. 2 Phillips screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

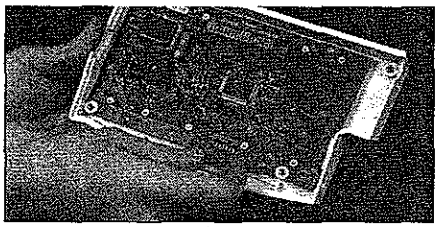


Figure 14

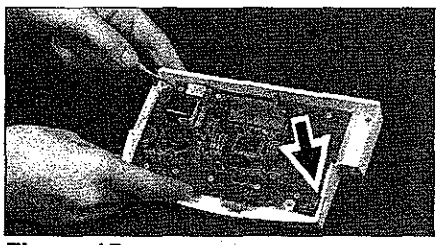


Figure 15

Note: Review the contents of the Bezel Top/Membrane Switch replacement parts kit (see Replacement Parts List on page 66), to confirm which parts you may need to keep/discard during disassembly.

Procedure

1. Remove the bezel enclosure per the Removing the Bezel Enclosure procedure on page 20.
2. Disconnect the membrane switch mylar ribbon cable from the display PCB (see Figure 14).
3. Remove the four (4) 4-40x1/4" Phillips pan-head screws which attach the display PCB/LCD assembly to the bezel top. Separate the display PCB/LCD assembly from the bezel top by gently pulling up on the display PCB corners as illustrated in Figure 15. Take care to retain the two o-rings on the temperature jack of the display PCB (arrow in Figure 15).

Caution: The display PCB/LCD assembly contains the LCD which is easily scratched. Be sure to handle this assembly with care.

Installing the Bezel Top

Equipment Required

- No. 1 Phillips screwdriver
- No. 2 Phillips screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

Procedure

1. The bezel top/membrane switch kit comes with a new membrane switch and panel seal. To install, follow the Installing the Membrane Switch procedure on page 25.
2. Perform the Functional Checkout procedure (see page 7) to ensure that all display and general Monitor functions are working properly.

Membrane Switch

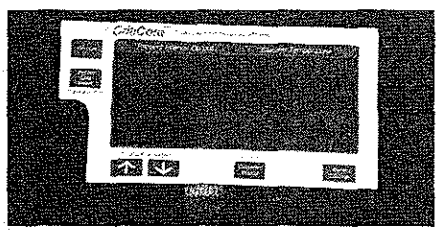


Figure 16

The membrane switch (Figure 16) is a multi-layered label containing 6 contact switches. The membrane switch is attached to the bezel top via an adhesive backing. A mylar ribbon cable with a connector is attached and connects the membrane switch to the display PCB. The center viewing area is transparent and provides the user visibility of the Liquid Crystal Display (LCD). The membrane switch also protects the LCD from fluids, scratches, and impact.

Note: There are two versions of the membrane switch. The original membrane switch design has gridlines screened onto the viewing area, and is used with an LCD that does not have gridlines.

The current membrane switch design does not have gridlines screened onto the viewing area. This membrane switch is designed for use with an LCD which has gridlines screened onto the viewing area.

Gridlines provide distinct separation between the 6 sections of the LCD. If you need to replace an original membrane switch, you will need to replace the LCD to ensure that gridlines are visible to the user.

Visually inspect the membrane switch for damage. If the membrane switch is punctured or torn, it could possibly allow fluids to enter into the display PCB and should be replaced.

Testing the Membrane Switch

Equipment Required

- Ohmmeter

Procedure

1. Remove the bezel top per the Removing the Bezel Top procedure on page 22.
2. Use an ohmmeter to check the resistance between each of the contact pins and the common pin per Figure 17. In Figure 17, the left-most contact (pin 1) is the common line, with the other lines being the signals from the switches. Verify that there is continuity and check for intermittent failure by applying pressure to the corresponding button for each of the six (6) contacts for several seconds, monitoring the ohmmeter for any break in the circuit. If necessary, refer to the Display Schematic located at the end of the manual. If any of the contacts show signs of an open circuit or intermittent failure, the membrane switch probably needs to be replaced.
3. If all contacts pass the continuity check and the problem persists, there may be a defect on the main PCB. If available, connect the suspect membrane switch to another *CritiCore Monitor* to verify problem.

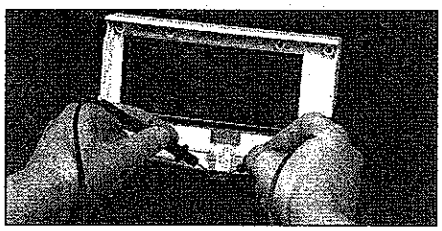


Figure 17

Removing the Membrane Switch

Equipment Required

- No. 1 Phillips screwdriver
- No. 2 Phillips screwdriver
- Small standard screwdriver
- Needle nose pliers

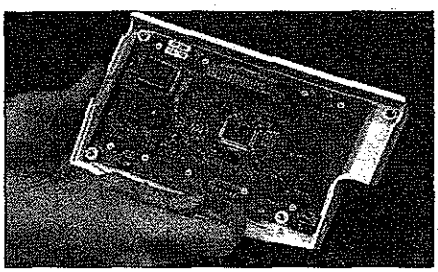


Figure 18

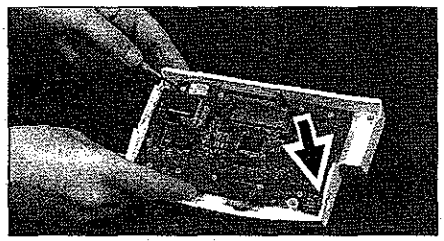


Figure 19

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

Note: Review the contents of the Membrane Switch replacement parts kit (see the Replacement Parts List on page 66), to confirm which parts you may need to keep/discard during disassembly.

Procedure

1. Remove the bezel enclosure per the Removing the Bezel Enclosure procedure on page 20.
2. Disconnect the membrane switch mylar ribbon cable from the display PCB (see Figure 18).
3. Remove the four (4) 4-40x1/4" Phillips pan-head screws which attach the display PCB/LCD assembly to the bezel top. Separate the display PCB/LCD assembly from the bezel top by gently pulling up on the display PCB corners as illustrated in Figure 19). Take care to retain the two o-rings on the temperature jack of the display PCB (arrow in Figure 19).

Caution: The display PCB/LCD assembly contains the LCD which is easily scratched. Be sure to handle this assembly with care.

4. Remove and discard the 4 panel seal strips located on the underside of the membrane switch (see Figure 20).
5. Turn the bezel top over. Using a small standard screwdriver, lift up one corner of the membrane switch. Peel off the membrane switch from the bezel top and discard.

Installing the Membrane Switch

Equipment Required

- No. 1 Phillips screwdriver
- No. 2 Phillips screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

Procedure

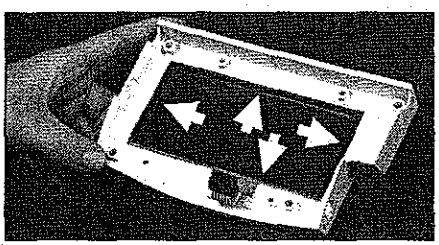


Figure 20

1. Ensure that the bezel top is free from any adhesive residue, oil, or foreign matter.

Note: 70% Isopropyl Alcohol will remove any remaining adhesive.

2. Peel off and remove the adhesive backing on the membrane switch, and carefully adhere it onto the bezel top.
3. Turn the bezel top over. Peel off the adhesive backing on each of the four strips of panel seal, and attach them to the underside of the membrane switch as illustrated in Figure 20.

Caution: **Panel seal strips should meet flush in the corners with no overlapping.**

Note: Ensure that there is no lint or foreign matter on the LCD or on the membrane switch before proceeding with the installation.

4. Install the display PCB/LCD assembly to the bezel top ensuring alignment of temperature jack, by installing the four (4) 4-40x1/4" Phillips pan-head screws.
5. Reconnect the membrane switch mylar connector to the display PCB (see Figure 21).
6. Install the bezel enclosure per the Installing the Bezel Enclosure procedure on page 21.
7. Perform the Functional Checkout procedure (see page 7) to ensure that all display and general *CritiCore Monitor* functions are working properly.

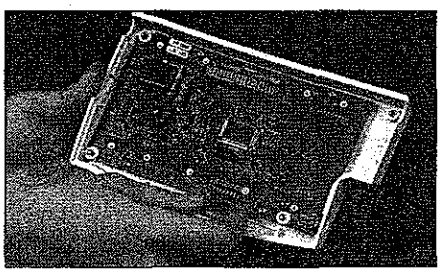


Figure 21

Display PCB

The display PCB (Printed Circuit Board) provides the transfer of data between the user and the main PCB. The display PCB is directly attached to the bezel top, and is connected to the main PCB with the display cable.

The display PCB contains the LCD driver electronics and provides the electrical and mechanical connections with the LCD.

The display PCB also contains a temperature jack and a phototransistor:

The temperature jack provides an insertion site for a temperature probe utilizing a mono phone plug. The Monitor is designed convert the resistance of a 400-Series thermistor into the appropriate relative temperature reading.

The phototransistor contains an IR emitting diode and IR photodetector. The diode and detector are designed to detect the cap on the disposable collection container.

Testing the Display PCB Electronics

Procedure

1. Perform the Functional Checkout procedure to verify the suspect function of the display PCB. Refer to the following tests to isolate the problem(s) to the display PCB.
   - Testing the Phototransistor (page 55)
   - Testing the Temperature Jack (page 27)
   - Testing the Liquid Crystal Display (LCD) (page 30)

Temperature Jack

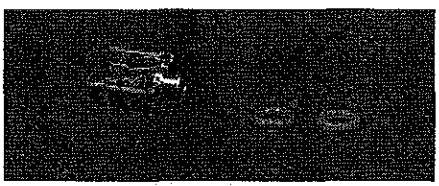


Figure 22

The temperature jack connector is available as a replacement part. Follow the procedures below to test, remove, and install the temperature jack connector.

Note: Before you test the temperature jack, perform the Testing the LCD procedure (on page 30) to verify that all LCD status indicators are functioning properly.

Testing the Temperature Jack Connector

Equipment Required

- Calibration plug or temperature-sensing Foley catheter

Procedure

1. Turn the Monitor on.
2. Connect a calibration plug or temperature-sensing Foley catheter to the jack on the display assembly. Note that there should be a temperature reading in the *Bladder Temperature* window of the display (The readings will vary depending on the air temperature as well as the *F°* or *C°* setting on the Monitor).
3. Verify that there are no intermittent readings by gently moving the probe, and pulling the probe out and plugging it back in several times. If intermittent readings are observed during this test, the temperature jack must be replaced.

Note: The calibration of *Bladder Temperature* is not performed by adjusting any components on the display PCB. If you suspect your Monitor is out of temperature calibration, see the Installing and Calibrating the Main PCB procedure (on page 58) for information.

Removing the Temperature Jack Connector

Equipment Required

- No. 1 Phillips screwdriver
- No. 2 Phillips screwdriver
- Small standard screwdriver
- Needle nose pliers
- Desoldering tools

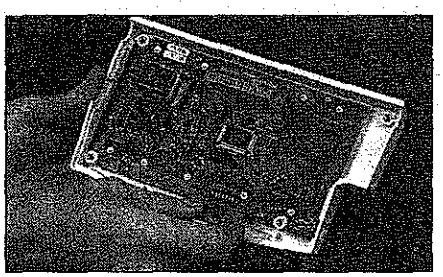


Figure 23

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

Note: Review the contents of the temperature jack replacement parts kit (see the Replacement Parts List on page 64), to confirm which parts you may need to keep/discard during disassembly.

Procedure

1. Remove the bezel enclosure per the Removing the Bezel Enclosure procedure on page 20.
2. Disconnect the membrane switch mylar ribbon cable from the display PCB (see Figure 23).
3. Remove the four assembly screws which attach the display PCB/LCD assembly to the bezel top. Separate the display PCB/LCD assembly from the bezel top by gently pulling up on the display PCB corners as illustrated in Figure 24.

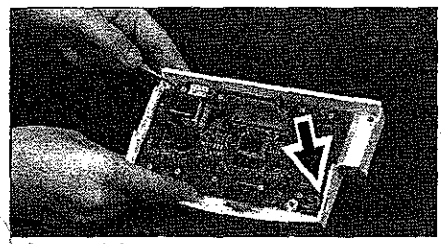


Figure 24

Caution: The display PCB/LCD assembly contains the LCD which is easily scratched. Be sure to handle this assembly with care.

4. Set the display PCB/LCD assembly so that the LCD display faces up and the temperature jack is in the lower left hand corner. Remove and discard the two o-rings on the temperature jack connector mount.
5. The temperature jack has three pins soldered to the display PCB (see Figure 25). To remove the temperature jack, desolder all three pins completely. The display PCB has been conformal coated, so the connector may "stick" slightly when removing.

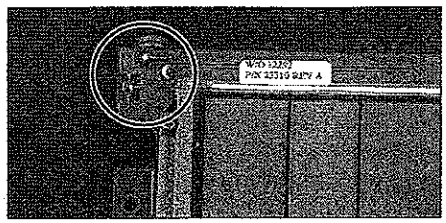


Figure 25

Installing the Temperature Jack

Equipment Required

- No. 1 Phillips screwdriver
- No. 2 Phillips screwdriver
- Needle nose pliers
- Desoldering tools
- 70% isopropyl alcohol
- PCB conformal coating material

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

Procedure

1. Solder the replacement temperature jack as supplied by Bard. Be sure to position the connector edge with the edge of the PCB and within the silk-screen lines on the display PCB (see Figure 26).
2. Using a non abrasive cloth dampened with 70% Isopropyl Alcohol, be sure to remove any remaining solder flux. Using a brush, apply a light layer of conformal coating material onto the leads of the connector. Allow coating sufficient time to dry as called out by the coating manufacturer before further assembly.

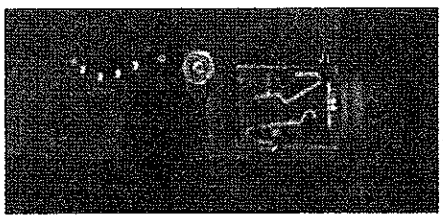


Figure 26

Note: Conformal coating materials protect the leads of the electronic components from corrosion. Coating the leads of the connector will prolong the life of the component.

3. Replace the two o-rings onto the jack connector mount.
4. Install the display PCB/LCD assembly to the bezel top assuring alignment of temperature jack, by installing the four (4) 4-40x1/4" Phillips pan-head screws.
5. Reconnect the membrane switch mylar connector to the display PCB (see Figure 27).
6. Install the bezel enclosure per the Installing the Bezel Enclosure procedure on page 21.
7. Perform the Testing the Temperature Jack Connector procedure (on page 27) to verify proper function.
8. Perform the entire Functional Checkout procedure to ensure that all display and general Monitor functions are working properly.

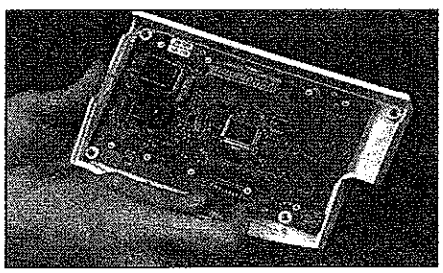


Figure 27

Liquid Crystal Display (LCD)

The LCD is a custom segmented glass panel which provides functional information to the user. The LCD is attached to the display PCB via "zebra" strips and "zebra" retainers. Zebra strips are soft, compressible foam strips which provide electrical contact between the display PCB and LCD contact pads. The zebra retainer provides that mechanical support to compress the zebra strips between the display PCB and LCD.

Note: There are two versions of the LCD. Early versions of the membrane switch had gridlines screened onto the viewing area, and were used with an LCD that did not have gridlines.

The current membrane switch does not have gridlines screened onto the viewing area. This membrane switch is designed for use with an LCD which has gridlines screened onto the viewing area.

Gridlines provide distinct separation between the 6 sections of the LCD. If you need to replace an early version of the membrane switch, you will need to replace the LCD to ensure that gridlines are visible to the user.

Testing the Liquid Crystal Display (LCD)

Visually inspect the LCD for damage. If the LCD is cracked or physically broken, it must be replaced.

If it is suspected that a segment or status indicator is not being displayed properly, it will be necessary to determine if the problem is the LCD, or another component of the Monitor. See the Troubleshooting section (starting on page 13) for details.

Procedure

1. Turn the Monitor off. Open the rear control panel door and set the TEST SWITCH to the T_2 position. Close the rear control panel door.

Note: If you have installed a *CritiCore* Communications Module, your TEST SWITCH label has been replaced by a COMMUNICATIONS MODULE label.

For purposes of this test, the display will be broken up into two main categories: Segment groups and status indicators:

Segment groups will refer to the seven groups of numeric indicators for *Present Interval Output, Bladder Temperature, Time, Interval Length, Prior Output Interval Ending Time, Prior Output Volume* and *Flow Rate/ Container Volume.*

Status Indicators will refer to all of the remaining indicators; *Set Value, Check Container, Low Battery, AM* and *PM* indicators, *ML/HR* indicator, alarm bell icon, etc.

2. Turn the Monitor on while observing the display. The Monitor will first complete a self test cycle lasting approximately 4 seconds. During this test all of the segment groups and status indicators will be lit, and the display should resemble Figure 28.

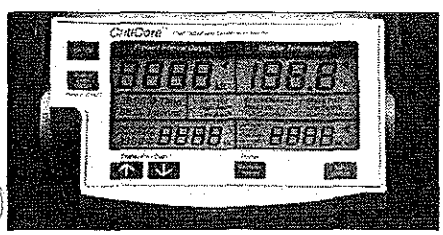


Figure 28

3. Following the self test, the display will begin to "cycle" segment groups and status indicators in the following manner:

Note: Depending on the internal state of the CPU, the "cycle" may start with a different value than that which is listed below. This cycle will repeat itself until the TEST SWITCH is moved off of the T_2 position, or until the Monitor is turned off.

The segment groups will begin to cycle through successive decimal and hexadecimal values, with each individual segment of each segment group displaying the same number or letter. The display will cycle through each step, remaining at each step for approximately 1.5 seconds.

All status indicators will not turn on when the segment values cycle through the following:

0, 2, 4, 6, 8, A, C, E, 0, 2, 4, 6, 8, "-", L, E see Figure 29 for an example.

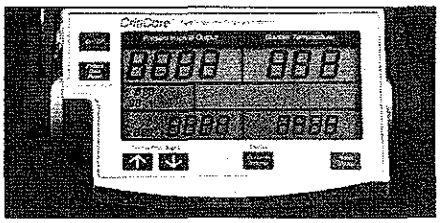


Figure 29

All status indicators will be turned on when the segment values cycle through the following:

1, 3, 5, 7, 9, b, d, F, 1, 3, 5, 7, 9, H, P, (blank) see Figure 30 for an example.

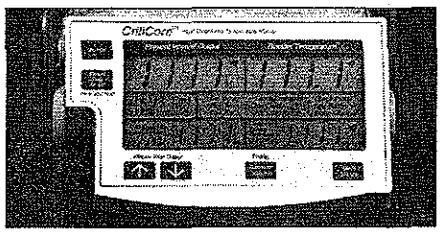


Figure 30

4. If the Monitor does not cycle through as described, you may have a faulty main PCB. You can either replace the main PCB (refer to the Main PCB section on page 58), or return the Monitor to Bard for service.

Removing the Liquid Crystal Display (LCD)

Equipment Required

- No. 2 Phillips head screwdriver
- No. 1 Phillips head screwdriver
- Small standard screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

Note: Review the contents of the LCD replacement parts kit (see the Replacement Parts List on page 64), to confirm which parts you may need to keep/discard during disassembly.

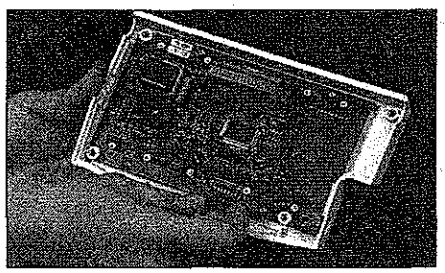


Figure 31

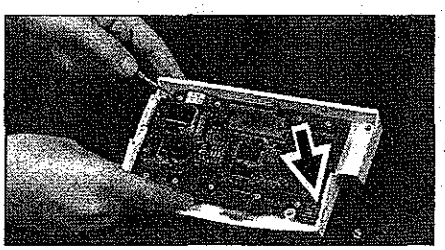


Figure 32

Procedure

1. Remove the bezel enclosure per the Removing the Bezel Enclosure procedure on page 20.
2. Disconnect the membrane switch mylar ribbon cable from the display PCB (see Figure 31).
3. Remove the four (4) 4-40x1/4" Phillips pan-head screws which attach the display PCB/LCD assembly to the bezel top. Separate the display PCB/LCD assembly from the bezel top by gently pulling up on the display PCB corners as illustrated in Figure 32. Take care to retain the two o-rings on the temperature jack of the display PCB (arrow in Figure 32).

Caution: The display PCB/LCD assembly contains the LCD which is easily scratched. Be sure to handle this assembly with care.

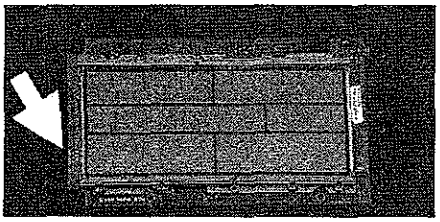


Figure 33

4. Place the display PCB/LCD assembly so that the LCD is facing upwards. Ensure that the two solder connections "ELP1" and "ELP2" on the display PCB are positioned to your lower left (see Figure 33).

Note: Before further disassembly, note that the pink zebra strips are "sandwiched" between the LCD and the display PCB. Also note that the backlight (the light green panel) is lying below the LCD, bordered by the zebra retainers and soldered into ELP1 and ELP2.

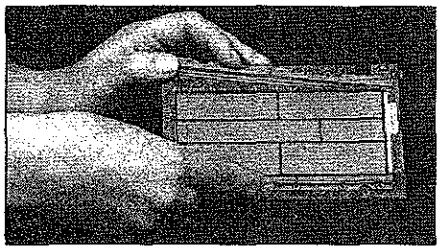


Figure 34

5. Using a No. 1 Phillips head screwdriver, remove the nine (9) 2-56x5/16" Phillips pan-head screws, 2-56 hex nuts, and #2 nylon washers securing the zebra retainer to the display PCB.
6. Gently pull the zebra retainers away from the LCD as illustrated in Figure 34. The zebra strips may "stick" to the LCD, so you may have to pull at the retainers with increasing force. Be careful to note that the backlight panel is still soldered to ELP1 and ELP2. Remove the LCD, and zebra strips from the zebra retainer.

Installing the Liquid Crystal Display (LCD)

Equipment Required

- No. 2 Phillips head screwdriver
- No. 1 Phillips head screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

Procedure

Note: This procedure was written for right-handed individuals. The converse of all highlighted position identifiers will work for left-handed individuals.

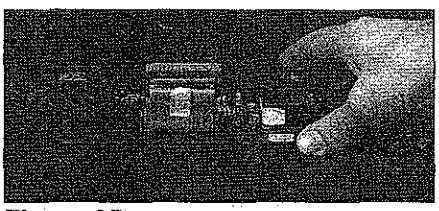


Figure 35

1. Inspect the conductor pads of the display PCB. Ensure that they are free of any contamination (oil, dirt, etc.) You can clean the pads by gently rubbing the pads with a non-abrasive cloth dampened with 70% isopropyl alcohol. Ensure that your hands are free of oil and dirt before further assembly.
2. Inspect the LCD pads and zebra strips. Ensure that they are free of any contamination (oil, dirt, etc.). You can clean these components by gently rubbing the pads and retainers with a non-abrasive cloth dampened with 70% isopropyl alcohol.
3. Place the Display PCB with the conductor pads face down (on a clean soft, surface), so that the display cable is ***facing you.*** (see Figure 35).

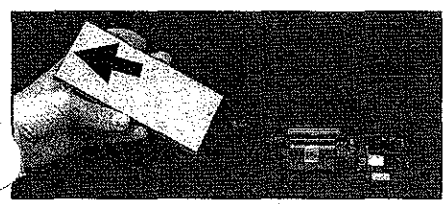


Figure 36

4. Position the LCD in your ***left hand*** so you hold the LCD along it's pad connection edges, with the back (papered side) facing up (see Figure 36).

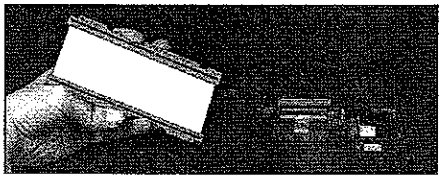


Figure 37

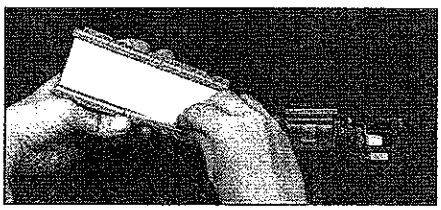


Figure 38

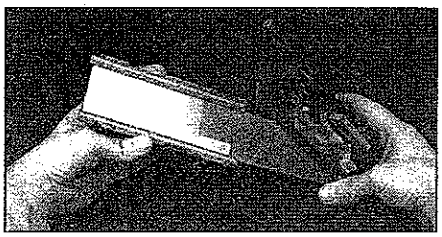


Figure 39

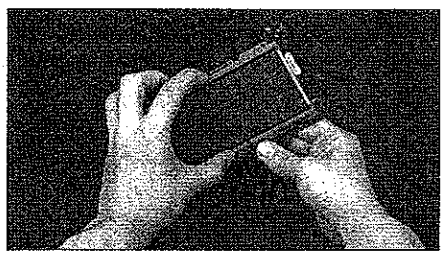


Figure 40

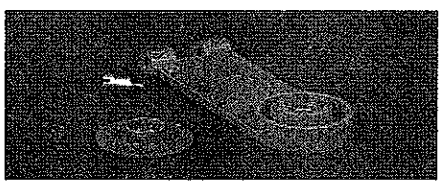


Figure 41

5. On one of the edges of the LCD there is a small "bump". Ensure that the "bump" is towards your ***left*** (see arrow in Figure 36).
6. Insert the long edges of the LCD into the zebra retainers, making sure that the retainer's flanges are facing upwards. The retainers may want to fall slightly inwards as you hold the assembly in your hand.

Note: For next few steps, it is important to keep just enough pressure to ensure that the LCD is seated into the zebra retainers (see Figure 37).

7. Carefully insert the zebra strips into their appropriate slots in the retainer. (see Figure 38).
8. Pick up the display PCB with your ***right hand*** and carefully guide the backlight over the LCD and between the zebra retainers (see Figure 39).
9. Once the backlight is slid into place, lay the display PCB onto the LCD assembly in your ***left hand***.
10. Gently turn the entire assembly over into your ***right hand***, while keeping the zebra retainers against the LCD and the display PCB (see Figure 40).
11. Carefully position the LCD assembly so that the zebra retainer mounting holes match the display PCB holes. When the holes are lined up, insert nine (9) 2-56x5/16" Phillips pan-head screws beginning with the four corner holes, and then the remaining five (5) holes (excluding the hole directly under the display cable).
12. Place the #2 nylon washer and 2-56 hex nut onto each screw and tighten. Tighten to approximately 2.5 in/lbs. of torque.
13. Replace the two o-rings onto the temperature jack.
14. Install the display PCB/LCD assembly to the bezel top, assuring alignment of temperature jack, by installing the four (4) 4-40x1/4" Phillips pan-head screws.
15. Reconnect the membrane switch mylar connector to the display PCB.
16. Install the bezel enclosure per the Installing the Bezel Enclosure procedure on page 21.
17. Perform the Testing the LCD procedure (on page 29) to confirm that all of the LCD segments and status indicators are functioning properly.
18. Perform the Functional Checkout procedure (on page 7) to ensure that all display and general Monitor functions are working properly.

Arms

The Bard *CritiCore Monitor* arms allow the Monitor to be hung on an object such as a hospital bed rail. The arms are directly attached to the front enclosure and must move unhindered. The movement of the arms allow the Monitor to hang on a level plane. The arms also indirectly attach the handle to the front enclosure.

The arm is secured to the enclosure by a shoulder screw, which rides on a bearing that is press-fit into the arm.

Testing the Arms

Procedure

1. Visually inspect each arm, if either arm is bent, cracked, or broken, the arm(s) must be replaced.

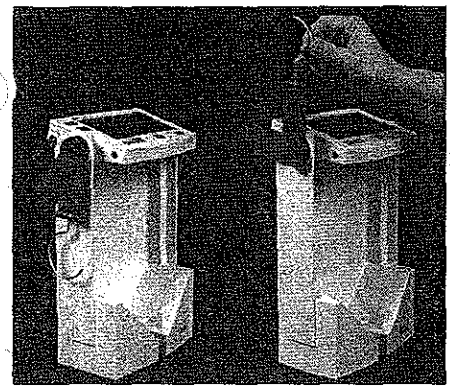


Figure 42

2. Turn the Monitor so that you are facing the front. Note the range of movement for each arm. The arm should rest as the left Monitor in Figure 42 indicates, and move freely to the position shown in the right Monitor in Figure 42 If the arm does not move freely, inspect the bearing to see if it is contaminated.
3. Each arm contains a molded, internal plastic step which catches on a similar molded plastic step on the handle. This causes the handle to raise as the arm is raised.
4. Repeat step 2 and raise each arm. Verify that each arm catches and raises the handle. If the handle does not raise with each arm, then either the handle or the arm has a broken plastic step.

Removing the Arms

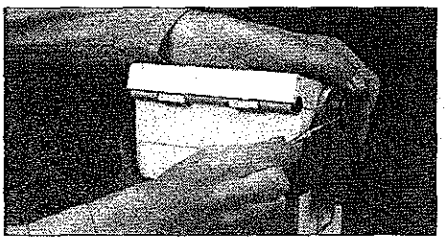


Figure 43

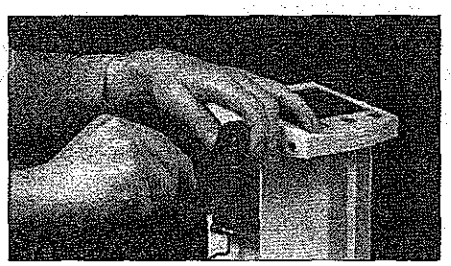


Figure 44

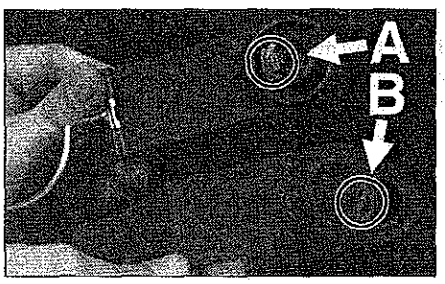


Figure 45

Equipment Required

- Small jeweler's screwdriver
- Standard screwdriver
- 3/8" socket and driver

Note: Review the contents of the Arm replacement parts kit (see the Replacement Parts List on page 64), to confirm which parts you may need to keep/discard during disassembly.

Procedure

1. Remove the arm cap by inserting a small flat head jeweler's screwdriver between the arm cap and the arm as illustrated in Figure 43.
2. Remove the shoulder screw to separate the arm from the enclosure as in Figure 44.

Note: There are two shoulder screw configurations; slotted head screw and a hex head screw. The slotted shoulder screw is used with a small washer. Keep this washer only if a hex head shoulder screw is not available as a replacement. Use a large flat head screwdriver for the slotted head screw and a 3/8" hex head nut driver to remove the hex head screw.

3. Visually inspect the bearing to verify that there is no contamination which would cause it to bind up. If the bearing is contaminated, clean out the bearing with either compressed air or a non abrasive cloth dampened with 70% Isopropyl Alcohol. If available, apply two drops of a non-silicone-based lubricant to the bearing.

Note: Some oils have chemical compounds which may attack the plastic enclosure. Use only oil/grease which will not attack the Cycaloy plastic material of the front enclosure or the nylon material of the arms.

4. Visually inspect the molded plastic steps. Item A in Figure 45 is the step on the inside of the arm. Item B is the step on the outside of the handle. If either step is cracked or broken, the respective part must be replaced.

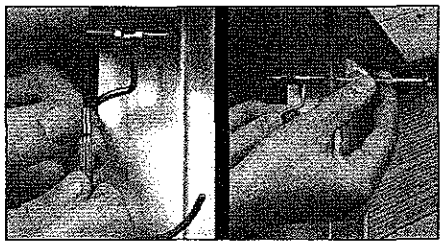


Figure 46 Figure 47

5. If the arm must be replaced, the hooks need to be removed. Separate the hook caps by inserting a small flat head jeweler's screwdriver between each hook cap and the arm as illustrated in Figure 46.
6. Using a small jeweler's screwdriver or wire, push the dowel pin out of the arm insert and remove the hook as illustrated in Figure 47.

Installing the Arms

Equipment Required

- Standard screwdriver
- 3/8" socket and driver

Note: Do not pre-lubricate the bearing in a replacement arm received from Bard.

Procedure

1. If the handle was removed prior to arm installation, ensure that the handle has been attached in the proper orientation (see the note in the Installing the Handle procedure on page 35).
2. Replace the shoulder screw, tightening the screw to 15in/lbs. of torque. Replace the arm cap.

Note: Ensure that the hook is installed with the proper orientation. With the Monitor facing you and the arms hanging down, the hook(s)- openings should face towards the front of the Monitor (see left Monitor in Figure 42).

3. Reattach the hook to the arm by inserting the dowel pin through the hook and arm insert. Secure the dowel pin by replacing the hook caps onto the arm.
4. Perform the Testing the Arms procedure (page 32) to verify that the arms move freely.

Handle

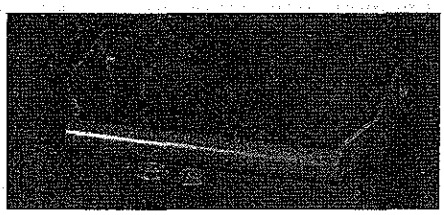


Figure 48

The Bard *CritiCore Monitor* handle allows the Monitor to be easily transported. The handle also keeps the Monitor pushed away from an object when the Monitor is hung by the hooks. It is necessary to keep the Monitor away from any objects so as to allow the Monitor to hang freely on a level plane. The handle raises when the arm(s) are raised. The handle is attached to the arm, which is attached to the front enclosure.

Testing the Handle

Procedure

1. Visually Inspect the handle, if the handle is cracked or broken, the handle must be replaced.
2. Each handle contains a molded, plastic step which catches on a molded plastic step on the arm. This causes the handle to raise as the arm is raised.

3. Raise each arm of the Monitor. Verify that each arm catches and raises the handle. If the handle does not raise with each arm, then either the handle or the arm has a broken plastic step.

Removing the Handle

Equipment Required

- Small jeweler's screwdriver
- Standard screwdriver
- 3/8" socket and driver

Procedure

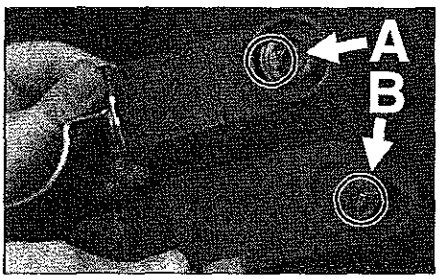


Figure 49

Note: Review the contents of the Handle replacement parts kit (see the Replacement Parts List on page 64), to confirm which parts you may need to keep/discard during disassembly.

1. Remove both arms from the Monitor per the Removing the Arms procedure on page 33.
2. Visually inspect the molded, plastic step on the ends of the handle (see item B in Figure 49), if the step is cracked or broken, the handle must be replaced.
3. Pull outwards on the handle ends to release it from the front enclosure.

Installing the Handle

Equipment Required

- Standard screwdriver
- 3/8" socket and driver

Procedure

Note: Before installing the handle, ensure that the molded plastic steps are oriented the proper way. With the handle held straight up over the Monitor, the outer step of the handle should be down and slightly towards the front of the Monitor.

1. Pull outwards on the handle ends to install the handle onto the front enclosure.
2. Install each arm per the Installing the Arms procedure on page 34.
3. Perform the Testing the Handle procedure on page 34 to verify proper operation.

Hooks

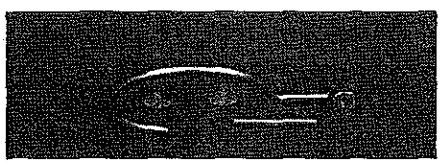


Figure 50

Each Bard *CritiCore Monitor* Hook is attached to the arms and together they allow the Monitor to hang from an object such as a hospital bed rail. The hooks are hinged to the arm by a dowel pin (see Figure 50).

Testing the Hooks

Visually inspect the hook. If the hook is bent, stretched or broken it must be replaced.

Removing the Hooks

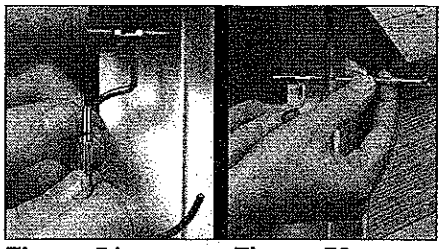


Figure 51 Figure 52

Equipment Required

- Small standard screwdriver

Procedure

Note: Review the contents of the Hook replacement parts kit (see the Replacement Parts List on page 64), to confirm which parts you may need to keep/discard during disassembly.

1. Separate the hook caps by inserting a small jeweler's screwdriver between each hook cap and the arm as illustrated in Figure 51.
2. Using a small jeweler's screwdriver, push the dowel pin out of the arm insert and remove the hook as illustrated in Figure 52.

Installing the Hooks

Procedure

1. Replace the hook onto the arm by inserting the dowel pin through the hook and arm insert. Ensure that the hook is installed with the proper orientation: With the Monitor facing you and the arms hanging down, the hook(s) opening should face towards the front of the Monitor.
2. Secure the dowel pin by replacing the hook caps onto the arm.
3. Visually inspect the hook to ensure that the hook caps are secure and that the hook moves freely.

Front Enclosure Assembly

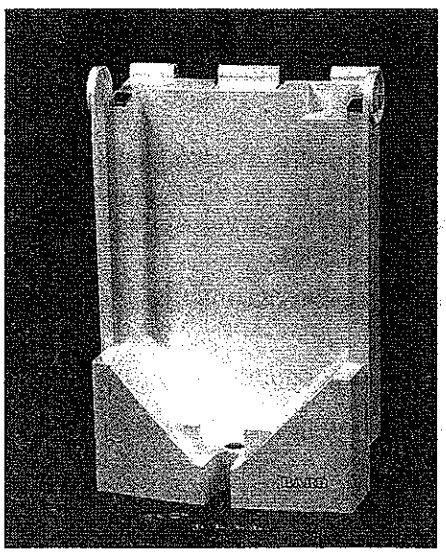


Figure 53

The front enclosure assembly contains the front enclosure, handle, arms, and select hardware. Attached to the front enclosure are the plastic retainers and attraction plates. The plastic retainers are located on the inside of the front of the Monitor. These retainers allow for the disposable container to remain seated in the Monitor, and atop the transducer. The attraction plates are adhered to the upper portion of the Monitor next to the arms. The magnets on the bezel enclosure are drawn to the attraction plates. The force of attraction is necessary to apply pressure to the top of the disposable container. The force on the container cap ensures that the container is firmly seated on the transducer cap. This in turn allows for minimal ultrasound signal loss when the container has little or no fluid inside.

Directly mounted to the front enclosure are the display assembly, main PCB, transducer/transducer cap and rear enclosure.

Note: Figure 53 illustrates the front enclosure without the handle and arms.

Testing the Front Enclosure Assembly

Visually inspect the front enclosure, if the front enclosure is cracked or broken it must be replaced.

Removing the Front Enclosure Assembly

Equipment Required

- Small standard screwdriver
- No. 2 Phillips screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

Procedure

Note: Review the contents of the front enclosure replacement parts kit (see the Replacement Parts List on page 64), to confirm which parts you may need to keep/discard during disassembly.

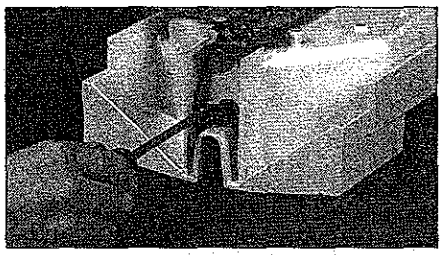


Figure 54

1. Remove the hooks per the Removing the Hooks procedure on page 36.
2. Remove the rear enclosure per the Removing the Rear Enclosure procedure on page 39.
3. Remove the two (2) 6-32x3/8" Phillips pan-head screws that secure the transducer, and pull out the transducer and transducer cap from the front enclosure as illustrated in Figure 54.
4. Remove the four (4) 6-32x3/16" Phillips pan-head screws which secure the main PCB to the front enclosure (see Figure 55). Lift up and remove the main PCB.

Installing the Front Enclosure Assembly

Equipment Required

- Small standard screwdriver
- No. 2 Phillips screwdriver
- Needle nose pliers

Caution: The Bard *CritiCore Monitor* main and display PCB's contain static sensitive electronic devices. Do not attempt to repair any internal components without proper ESD (Electro-Static Discharge) handling equipment. Failure to properly ground both your body and your work station could result in damage to the Monitor.

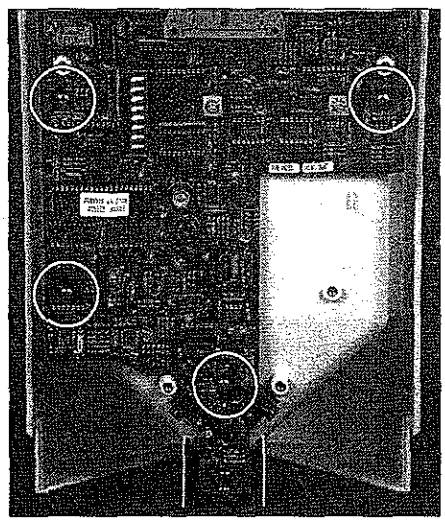


Figure 55

Procedure

1. Install the four (4) 6-32x3/16" Phillips pan-head screws and attach the main PCB to the front enclosure (see Figure 55).

Note: Ensure that there is no dirt, oil or contamination on the transducer cap or transducer.

2. Place the transducer cap onto the transducer. Install the two (2) 6-32x3/8" Phillips pan-head screws and attach the transducer/cap to the front enclosure as illustrated in Figure 54. Ensure that the transducer cable will not be pinched when the rear enclosure is attached.

3. Install the rear enclosure per the Installing the Rear Enclosure procedure on page 40.
4. Install the hooks per the Installing the Hooks procedure on page 36.
5. Perform the entire Functional Checkout procedure (on page 7) to ensure that all display and general Monitor functions are working properly.

Attraction Plates and Magnets

If an attraction plate becomes detached, and the front enclosure is not damaged, the plate may be replaced. If a magnet has become dislodged, and the bezel enclosure is not damaged, the magnet may be replaced.

Replacing an Attraction Plate

Equipment Required

- Small chisel or hobby knife
- Loctite 454 Adhesive (or equivalent)

Procedure

1. Remove any remaining adhesive residue in the attraction plate recess on the front enclosure. This can be done with a small chisel or hobby knife. Try a dry fit with the replacement attraction plate to ensure that the plate sits flush in the recess.
2. Place a small amount of Loctite 454 into the attraction plate recess. Immediately place the replacement attraction plate into place (adhere to either side of the plate). Be sure to wipe away excess adhesive which may have squeezed onto the top side of the plate.

Caution: Loctite 454 contains cyanoacrylate. Observe all necessary precautions as specified by the manufacturer for the safe handling of this adhesive.

3. Allow the bond to dry as specified by the manufacturer.
4. Without a container in the Monitor, completely close the display so that the magnets make contact with the attraction plates. Lift up on the display to verify that the attraction plate is still bonded to the front enclosure.

Replacing a Magnet

Equipment Required

- Small chisel or hobby knife
- Loctite 454 Adhesive (or equivalent)

Procedure

1. Remove any remaining adhesive residue in the magnet recess on the bezel enclosure. This can be done with a small chisel or hobby knife. Try a dry fit with the replacement magnet to ensure that the magnet sits flush in the recess.